Diffraction Anomalies in Martensites of Copper Based Beta Phase Alloys

O. Adıgüzel
Fırat University, Department of Physics, 23169, Elazig/Turkey
E-mail: oadiguzel@firat.edu.tr, oadiguzel@hotmail.com

Abstract

Copper based beta phase alloys and nearly equiatomic Ni-Ti alloys exhibit the shape memory effect, being associated with a thermoelastic martensite transformation and its reversion. Copper alloys are less stable than the Ni-Ti alloys above room temperature, and reverse transformation temperatures increase with holding duration in martensitic conditions. This phenomenon is often called “the stabilization of martensite and leads to the atom exchanges between the lattice sides. These properties were observed on two CuZnAl and CuAlMn alloys. Both alloy samples were homogenized in the beta phase field and quenched in iced brine. Then, different post-quench heat treatments were applied. Electron diffraction patterns and x-ray diffraction were taken from the heat treated specimens of alloys. X-ray diffraction profiles reveal that peak locations and intensities change depending on the heat treatments. This behaviour leads to the atom exchanges in the alloy.

The product martensites have the unusual layered complex structures such as 2H, 3R, 9R or 18R depending on the stacking sequences on the close-packed planes, unlike the ordinary structures. On the other hand, an 18R structure has 68 atoms, and a 9R structure has 16 atoms in unit cell, whereas ordinary bcc and fcc structures have 2 and 4 atoms in a unit cell, respectively. Due to this property, the differences in atomic size in the different atom species make the structure completely complex, and x-ray diffraction profiles exhibit some anomalies.

Key Words: Shape memory alloys, martensite, layered structures, anomaly.